Kyoto University,
Graduate School of Economics
Discussion Paper Series

There Did All the Markets Go!

Or: Sustainable Carbon Markets and How to Get There

Sven Rudolph, Elena Aydos, Takeshi Kawakatsu, and Achim Lerch

Discussion Paper No. E-17-001

Graduate School of Economics
Kyoto University
Yoshida-Hommachi, Sakyo-ku
Kyoto City, 606-8501, Japan

April, 2017

There Did All the Markets Go!

Or: Sustainable Carbon Markets and How to Get There

Sven Rudolph, Elena Aydos, Takeshi Kawakatsu, and Achim Lerch

"Where Did All the Markets Go?"[1] was a question prominent amongst environmental economists in the 1990s when they realized the lack of market-based approaches in environmental policy practice with despair. Public Choice, the economic analysis of politics, answered that question by claiming a "market tendency for the political process to resist market mechanisms for rationing scarce environmental resources."[2] And, while recently climate policy cap-and-trade programs have spread across the globe and even different governance levels, most carbon markets' ambition have to be considered insufficient.

But despite of all criticism of the "The Brave New World of Carbon Trading"[3], carbon markets offer a number of advantages over alternative policy instruments, and in view of the tremendous challenges of the Paris Agreement and the necessity to decarbonize the global economy within this century, any policy option should be (re-)considered without prejudices. Yet, exactly because there is no time to waste, carbon markets can only be considered a valuable policy option if they are both sustainable and political feasible; a contradiction? Can sustainable carbon markets ever be made politically feasible?

We think: yes! In order to support this, first, we will summarize environmental economics' arguments in favor of cap-and-trade and add a sustainability rationale for carbon markets, but from selected case studies we will also identify problems representative for many carbon markets in practice. We then identify the political barriers of sustainable carbon markets applying Public Choice reasoning. Last, we show how to overcome political obstacles and implement efficient, effective, and fair carbon markets by referring to best-practice examples and lessons from modern environmental governance literature.

1 The Route to Go and Where We Stand: Carbon Markets in Theory and Practice

Economists have long been outlining the advantages of cap-and-trade. As proposed by its inventor John H. Dales,[4] cap-and-trade fixes a total amount of allowed emissions for a region and a certain time period (cap), distributes emission allowances to polluters and obliges them to cover each and every unit of emissions by respective allowances (distribute), and then allows polluters to transfer emission allowances amongst each other (trade). Economic theory has proven that cap-and-trade is capable of accurately reaching any environmental target at

minimum cost to society independent of the initial distribution of emission allowances.[5] In addition, cap-and-trade also sets steady innovation incentives, implements the polluter-pays-principle, and reduces administrative as well as transaction costs.[6] Not least, linking domestic markets allows for developing a global carbon market, the most efficient solution, from the bottom up.[7]

Recognizing the limits of growth, Herman Daly explicitly emphasized that cap-and-trade is an exemplary way of separating and prioritizing the decisions on scale, distribution, and allocation in a sustainable economy beyond growth.[8] With cap-and-trade, governments decide about both the scale by fixing the cap and the distribution by allotting emission allowances to polluters. Only then does the market facilitate an efficient micro-allocation of emission rights.

In an earlier study we showed that even concrete carbon market design can be made sustainable.[9] By applying the following concepts, we derived a set of design requirements, which, if followed, would establish a carbon markets that is environmentally effectiveness, economically efficient, but also takes social justice considerations into account.

Table 1: Sustainable Carbon Market Design

Environmental Economics	Climate and Social Justice Concepts
static efficiency	procedural vs. result-oriented justice
attribution of costs	justice in transfer and acquisition vs. justice in allocation and redistribution
accuracy in achieving a target	desert-based vs. welfare-based justice
innovation incentives	egalitarianism vs. non-egalitarianism
administrative costs	inter- vs. intra-generational justice
transaction costs	national vs. international justice

From the environmental economics perspective we argue, e.g., that an absolute volume cap in line with the 2°C target would create a scarcity price signal, which leads to an efficient allocation while also limiting emissions to the necessary degree and setting innovation incentives. From the social justice perspective, such a target reflects the necessary result-orientation, makes the polluters pay, and protects future generations and countries suffering most from climate change from further injustices. Full auctioning, in addition, would lead to the most immediate optimal allocation, while auction revenues could be used for cushioning regressive cost effects on low-income households or for paying climate debts. Surprisingly, the resulting most design recommendations do not exhibit major contradictions between environmental, economic, and social goals, but rather point into the same direction (Tab. 2).

Table 2: Sustainable Carbon Market Design and Compliance in Practice

	Sustainable Design	EU	RGGI	WCI	TMG
Coverage	mandatory participation	●	●	●	●
	all GHG (based on CO_2e)	●	●	●	●
	all polluters	●	●	●	●
Cap	target 25-40% reduction by 2020, base 1990)	●	●	●	●
	absolute volume cap	●	●	●	●
	gradual cap reduction	●	●	●	●
Allocation	unit of 1 t of CO_2e/a	●	●	●	●
	100% auctioning	●	●	●	●
	frequent, non-discriminatory auctions	●	●	●	●
	equally accessible market	●	●	●	●
Revenue Use	100% revenue recycling (earmarked)	●	●	●	●
	for mitigation, adaptation, cost compensation	●	●	●	●
Flexibility Mechanisms	unlimited banking	●	●	●	●
	no borrowing	●	●	●	●
	offsets limited to sustainable projects	●	●	●	●
Price Management	price floor (≥ 20 US$/t), inflation adjustment	●	●	●	●
	price ceiling (≥ 100 US$/t), inflation adjustment	●	●	●	●
Compliance	control periods not longer than 3 years	●	●	●	●
	continuous emission monitoring or verified reporting	●	●	●	●
	emission and allowance tracking and registration	●	●	●	●
	fines (>p) for non-compliance	●	●	●	●
	over-compensation of excess emissions (at least 2x)	●	●	●	●
Supporting Measures	border adjustment	●	●	●	●
	linking	●	●	●	●

● full compliance ● partial compliance ● non-compliance

In policy practice, the merits of carbon markets have led to the spreading of the instrument across the globe and all governance levels.[10] Building on the Kyoto protocol's Flexible Mechanisms, in 2005 the European Union (EU) established what can still be considered the world's flagship, supra-national carbon market. At the national level carbon markets also exist in Switzerland, New Zealand, South Korea, and Kazakhstan. Japan and Australia used to have national programs in place, abolished them after political resistance, but are now re-considering implementation. China, having postponed the start of its national carbon market several times, has just re-scheduled the start to 2018. And additional big emitters such as Brazil, Canada, and Mexico are now vividly discussing a national scheme as well. Recently sub-national action has become even more dynamic and increasingly supported by the scientific and political community.[11,12,13] China has implemented city and regional level schemes e.g. in Beijing and Shanghai, as pilots for their national program, Tokyo has been using a carbon market since 2010, and US states in co-operation with Canadian provinces have advanced the establishment of a bottom-up, inter-linked North American carbon market.

The empirical evidence on the performance of more mature domestic carbon markets such as the EU Emissions Trading Scheme (EU ETS), The Regional Greenhouse Gas Initiative (RGGI), the California Cap-and-Trade Program (CalCaT), and the Tokyo Metropolitan Government

Emissions Trading Scheme (TMG ETS), however, is ambivalent. The design of these programs only partly complies with the criteria for sustainable carbon markets, and while California currently operates the most promising scheme, even the good programs suffer from serious deficiencies (Tab. 2).

Most programs have been heavily criticized for their low carbon prices. In the EU ETS the initial over-allocation and the economic crisis after 2008 in combination with the specific banking rules have resulted in an allowance price drop from around 30 € in 2006 to 5.50 € in December 2016, inducing some commentators to call the EU ETS "clinically dead".[14] In California, the allowance price stagnates at a low level of around 13 US$ just above the auctions' minimum price, while in the RGGI region even the dramatically reduced cap has only generated a CO_2 price of 7.50 US$/t.[15] And Tokyo's CO_2 price has dropped from an expected level of around 100 US$/t to about 15 US$ in October 2016.[16] While a low carbon price neither jeopardizes compliance with the cap nor static cost efficiency, there is a well-founded fear that the innovation incentives generated are insufficient for decarbonizing the EU economy within this century in a dynamically efficient way.

However, it has to be kept in mind that all implemented programs have at least achieved three important goals: They overcame political opposition against market-based approaches in climate policy, they established an overall cap on emissions and a carbon price, and they are achieving their targets at lower cost to society than most alternative instruments. Compliance has been almost 100% in all programs and actual emissions have even stayed significantly below the cap. In addition, individual programs have achieved remarkable things: The EU ETS overcame the political EU climate policy stalemate at the beginning of the 2000s.[17] RGGI achieved a cap reduction of more than 50% in a pre-schedule revision, while California has achieved coverage of more than 80%.[18] And Tokyo effectively used stakeholder consultations in the decision-making process and reduced energy-end-use emissions by 25% in only four years.[19,20]

Still, in sum, while carbon markets' theoretical advantages as well as some noteworthy achievements in practice are indisputable, the programs selected here cannot be considered sustainable. The major design flaws leading to unsatisfactory results are limited coverage, loose caps, a big share of free initial allowances allocation, and a too low price collar. The reasons for these insufficiencies can be attributed to political failure.

2 The Obstacles in the Way: The Political Economy of Carbon Markets

Public Choice, "the application of economics to ... the subject matter … of political science",[21] analyzes political decision-making by assuming rational, self-interested actors (homines oeconomici), who engage in quasi-markets for political outcomes. Politicians e.g. offer political programs that benefit voters and in return voters offer their votes in general elections. In a perfect market the "Trick of Democracy" matches the sovereign's preferences with political programs, just like Adam Smith's "Invisible Hand" matches consumer preferences with producers' production plans.[22,23] But just like markets for goods and services political markets are oftentimes imperfect and lead to unsatisfactory results. While certainly representing a worst-case scenario, Public Choice has convincingly outlined the political obstacles of market-based environmental policy.[24]

To begin with, when utility-maximizing voters cast votes, climate policy is not a priority topic.[25,26] While a stable climate certainly is a vital prerequisite for well-being, at least three arguments support that view. First, public goods such as a stable climate compete with private goods such as jobs for voters' attention in elections. In this situation, self-interested voters cast votes based on policy programs that provide private goods, and they free-ride on public good policies. Second, economic policy such as employment policy provides immediately perceivable monetary benefits, while climate policy only promises non-monetary future benefits. Third, the costs of climate policy are born by current generations and are easily perceivable, while the benefits oftentimes only occur to future generations and are less easy to observe.

The same pessimistic view applies to voters' perception of carbon markets. If climate policy in general is not a priority, instrument choice is even less. Voters therefore do not invest in information on a sub-topic of an anyway less relevant policy area. This leads to two misunderstandings: First, while carbon markets generate easily perceivable price signals via stock markets, non-monetary command-and-control standards rather generate cost-illusion and hide the real costs of emission abatement. Second, emission standards easily be understood and their effectiveness (mistakenly) appreciated based on e.g. the sheer number of regulations, while carbon markets are less well understood and they even reach their goals by utilizing the market and at the same time minimizing the number of individual regulations.

However, Public Choice considers voters to be politically ineffectual. If voters do not cast votes based on climate policy considerations, vote-maximizing politicians cannot gain or bind votes based on climate policy program contents. Hence, other policy issues feature more prominently in political programs. If politicians consider climate policy at all, they tend to focus on other

stakeholders preferences. The reason for that lies in the fact that, while facing the pre-requisite of re-election every few years, in between elections politicians' daily legislative work heavily depends on interest groups' and bureaucracies' support in program preparation and implementation. And, considering those actors preferences (see below), politicians' can be expected to be skeptical about carbon markets.

In addition, politicians are less interested in the real effects of policies but more in voters' perception of their actions.[27] Hence, to make policies attractive to politicians, benefits have to be perceptible, attributable to the individual politician, and expressible in quantitative terms. Costs, on the other hand, should be diffuse and not easily quantifiable. In this sense, as mentioned above, climate policy and carbon markets are rather unattractive. And this is true even though efficient policies would spare national budgets and auctioning of emission allowances would generate revenues. In contrast, by prescribing emission standards and state-of-the-art abatement technology in a command-and-control regime, politicians suggest that a strong government does everything it can to curb environmental degradation.

Regarding the two major interest groups in climate policy, Public Choice claims polluters' industry organizations to be significantly more influential than environmental non-governmental organizations (NGOs) for several reasons. First, heterogeneous NGOs suffer from diseconomies of scale, while polluting companies form a rather small and homogenous group with only minor incentives to free-ride.[28] Second, NGOs' goal of protecting the climate promises only future, non-monetary effects, while industry groups argue with current jobs and incomes. Third, in climate politics polluters' interests are often aligned with their employees' concerns about production costs and jobs, making industry groups and labor unions natural allies. Fourth, industry groups execute market-power on the labor market and can threaten to transfer production and jobs abroad. Fifth, polluters are quasi-monopolists in providing political decision makers with technical information on production and abatement technology as well as on related costs. Sixth, the financial resources of the industry-union-coalition are substantially larger than those of their NGO counterparts. Finally, industry commands over well-established formal and informal contacts with policy makers in the legislative and executive branch of the government, originating from long-time information exchange and collaboration in various fields, while NGOs only possess recently established networks amongst ecologically-minded stakeholders.

But only NGOs can be expected to support stringent carbon markets, because, first, from the outset, protecting the environment is the founding principle of NGOs and cap-and-trade promises to achieve pre-set emission reduction targets most accurately. Second, re-interpreting the

economic principle, cap-and-trade's cost efficiency allows for achieving maximum environmental effects at given expenditures. Third, carbon markets set incentivize abatement technology innovation. Fourth, auction revenues can be used for additional climate protection projects. And fifth, although environmentalists tend to be skeptical about fully-fledged rights-to-pollute and the conversion of nature into a marketable commodity, tradeable emission allowances make industry pay for the use of natural resources, hence complying with the strong polluter-pays principle.

Profit-maximizing industries, on the other hand, tend to resist environmental measures that generate net costs. Carbon markets, however, should be preferred over command-and-control, because they minimize overall compliance costs. Yet, overall cost savings are widely dispersed across the economy, and no single company profits noticeably. Quite in contrast, carbon markets make polluters fully pay for each and every unit of emissions, while command-and-control leaves emissions below the standard free-of-charge.[29] In addition, environmental technology standards often used in command-and-control regimes can lead to significant market entry barriers, when incumbents' technologies are prescribed for market newcomer. Furthermore, growth-oriented companies might fear the absolute emission cap to act as a limit to growth. Not least, emission allowance markets can be subject to unpredictable price fluctuations.

The environmental bureaucracy is expected to support environmental protection, as this is the principle justification of its existence, but they turn out to be skeptical towards market-based approaches.[30] Bureaucrats' primary goal of budget maximization makes them prefer policies that are resource- and labor-intensive with high administrative oversight requirements, because it is exactly this type of policy that calls for extensive budgets. In addition, the use of carbon markets not being in line with established command-and-control routines devaluates specialized technical knowledge about emission standards and induces additional costs of restructuring and adapting. Budget maximization also forces environmental bureaucrats to take into account budget-providing politicians' interests. Conflict minimization, a second goal of bureaucrats, encourages them to also seriously consider the concerns of politically influential polluters. But while politicians' influence on bureaucrats suffers from information asymmetries, polluters' skepticism towards carbon markets significantly influences environmental bureaucrats' point of view.

And most certainly, the bureaucrats' political influence has been increasing, oftentimes only leaving the mere legitimization of laws to the legislative branch. Bureaucrats, in turn, are in charge of both implementing regulations and preparing politicians' decisions. And in fact the

relation between the actual sub-ordinates and the budget-providing politicians is characterized by information asymmetries that allow bureaucrats to act in their own interest instead of following politicians' intentions. On the other hand, in a more and more complex world, bureaucrats increasingly depend upon interest groups' support. And, with only industry being able to provide the most valuable information about production technologies and respective abatement costs, this leads to a significant state of dependence.

In sum, Public Choice substantiates the "market tendency for the political process to resist market mechanisms for rationing scarce environmental resources" (Hahn 1987) with theoretical arguments, some even being supported by empirical data.[31] However, it has to be kept in mind that Public Choice' only offers a severely constricted perspective on policy making and largely relies on generalized ad-hoc assumptions. Still, especially when combined with case study evidence, important lessons can be learned for the implementation of sustainable carbon markets.

3 The By-pass to Success: Lessons from Carbon Market Best-practice

Almost fifty years of theoretical research on cap-and-trade as well as numerous practical experiences have taught important lessons about how to design and implement sustainable carbon markets.[32] Facing the huge challenge of keeping the global average temperature increase below 2°C, any policy instrument that promises a significant contribution to solving the problem should be most welcome, given it can be made truly sustainable. Considering Public Choice's lessons as well as experiences in practice, the following five Go's promise to open bypasses around some of the major obstacles of effective, efficient, and fair carbon markets:

Go sustainable! Future carbon markets have to fulfill ambitious criteria of sustainability (Tab. 2). They, first, have to be environmental effective in the sense that they significantly contribute to reaching the Paris Agreement target and to de-carbonizing the economy within this century. Second, they have to minimize the costs of achieving this target, because wasting money in times of limited national budgets and multiple societal problems means ignoring the urgency of reaching other goals such as the provision of clean air, water and soil, the protection of biodiversity, the reduction of poverty and injustices, the improvement of education and gender equality, and, not least, world peace; all prominently outlined in the UN Sustainable Development Goals. And third, carbon markets have to be socially just, a requirement described in detail below. Any inadequacy in the design will not only jeopardize the positive impacts of carbon markets, but also imperil the political feasibility and long-term survivability the respective scheme. Prominent examples for this are, first, the windfall profits in the EU ETS, which led to widespread criticisms of the program.[33] Second, the price fluctuations experienced in the EU

ETS, predominantly caused by over allocation as a result of effective industry lobbying in the early 2000s,[34] led to complaints by covered entities themselves but were also used as arguments against carbon markets in general by opposing forces in other countries such as Japan.[35] And third, unambitious caps and the resulting low carbon prices made even former supporters in the environmentally minded (scientific) community express their skepticism about the effectiveness of carbon markets.[36] Hence, the sustainability of carbon markets is not only a requirement for its environmental, economic, and social success but also for their political feasibility.

Go fair! Social justice can be expected to be one key issue in reforming established or introducing new carbon markets in the future, given international competitiveness concerns as well as the regressive effect of energy prices. This will be particularly true once the low-hanging fruits of cheap emission abatement options have been picked and costs are starting to increase more rapidly with increasing scarcity of emission rights. While free allocation of emission rights results in a bunch of problems such as windfall profits and competitive distortions, full auctioning combined with a reasonable scheme of revenue recycling is more promising. Full revenue neutrality and a pre-determined earmarking – with a certain degree of flexibility – would invalidate the political argument of governments wanting to increase their share of the Gross Domestic Product. And as leakage effects could be minimized by border adjustments, revenue recycling should be focused on compensating households. Empirical experiences are manifold such as lowering income taxes (British Columbia Carbon Tax), reducing social security contributions (German Ecological Tax Reform), or even dedicating parts of the revenues directly to disadvantaged communities (California Cap-and-Trade Program). Barnes, instead, promotes a per capita redistribution of revenues based on the idea of equal per capita rights to the use of natural resources.[37] In any case, communicating the monetary benefits of any redistribution scheme to the public is key for increasing the public acceptability of higher carbon prices and energy prices.

Go in steps! An ambitious, truly sustainable carbon market represents a rather dramatic deviation from the status quo of energy use and the generation of economic wealth. In order to make transformations such as this sustainable and politically feasible, a step-by-step approach is most promising, given it keeps up with the pace of emission reductions necessary to stabilize global warming well below 2°C, hence following Costanza and Daly's operational principals of strong sustainability for keeping total natural capital intact.[38] The step-by-step approach should particularly apply to design elements crucial for the political feasibility of carbon markets. First, coverage could be extended in terms of polluters and/or pollutants. California, e.g., started with

big polluters only and then expanded to transport and heating fuels. Second, like all implemented carbon markets in fact do, the cap size could be dynamically reduced from status-quo emissions to the necessary level. Third, auctioning of emission rights could be phased in as it has been done e.g. in the EU ETS. For all these approaches, a pre-scheduled roadmap is most promising, determining minor design changes but also general revision schedules. In practice, e.g. the EU ETS and RGGI have undergone major revision processes, which in each case significantly improved the design and performance.

Go participatory! Public Choice teaches us that major opposition to sustainable carbon markets is to be expected from covered polluters in alliance with polluter-friendly decision makers; hence, a balancing power is needed. Contradicting Public Choice, case study evidence shows that under certain conditions NGOs can act as an effective counterforce. However, in order to be able to exert pressure, first, NGOs have to be granted equivalent access to the political process, to policy planning, decision making, and implementation. The example of Tokyo shows how continuous and fair stakeholder consultations can help equilibrate industry's power.[39] Second, NGOs themselves have to closely co-operate within their own community but also with other pro-active forces. Ecological research institutes, open-minded politicians from green parties or green wings of other parties, and environmental bureaucrats are natural allies. The German example shows most vividly how the latter two stakeholder groups were much more EU ETS friendly than Public Choice predicts.[40] This example also teaches that coordinating positions within the environmental community exponentiate NGOs political power. Third, NGOs have to be financially empowered by governments, e.g. by tax reliefs, to defend the environment, which represents the classical case of a public good with strong incentives to free-ride. The German and US experiences with cap-and-trade show how financially strong NGOs such as World Wide Fund for Nature (WWF) or Environmental Defense Fund (EDF) effectively used funds for campaigning in favor of cap-and-trade programs.[41]

Go sub-national! Recent carbon market dynamics especially in North America and Japan have shown that local and regional schemes face less obstacles than federal level programs. In spite of the eventual failure in 2010 of both the Waxman-Markey-Bill in the US and the Integrated Domestic Market of Emissions Trading in Japan, RGGI, the WCI, and Tokyo succeeded in implementing sub-national carbon markets.[42,43] The New Environmental Federalism strongly supports this idea of sub-national jurisdictions, after warnings of a "race to the bottom" dominating an efficient "voting by feet" have proven to be exaggerated.[44] Recently, sub-national jurisdictions are considered to act as policy laboratories, in which measures can be tailor-made

to match locals' preferences but can also be tested for federal or even supra-national applications. In climate policy, this idea is also supported by Elinor Ostrom's poly-centric approach.[45] It is true, though, that the cost savings from carbon markets compared to non-monetary instruments is greatest in a global or at least national market, but linking sub-national carbon markets can be considered a viable second-best solution for developing a more comprehensive market from the bottom up.[46] The California-Québec link-up under the WCI with more members to join on the horizon, the Tokyo-Saitama conjunction, as well as the upcoming EU-Switzerland nexus are best-practice examples for successful carbon market linkages. And the US Clean Power Plan, although seriously threatened by the Trump administration, even provides a model rule for state-level carbon markets, which, if applied by states, provides almost guaranteed compliance with federal emission standards. Not least, Prime Minister Trudeau's October 2016 carbon pricing initiative also gives province-level action priority over a federal level Canadian pricing scheme.

In sum, building a global carbon market step-by-step from the bottom up by linking sub-national schemes can still be considered a valuable strategy for climate policy. However, a truly sustainable design, which specifically considers social justice concerns, as well as a participatory approach to political decision making and policy implementation, which particularly empowers the environmentally minded civic society, are indispensable for the short-term and long-term political success of ambitious carbon markets.

Authors and Acknowledgement

Dr. Sven Rudolph, Associate Professor, Graduate School of Economics, Kyoto University, Japan; Dr. Elena Aydos, Lecturer, University of Newcastle School of Law, Australia; Takeshi Kawakatsu, PhD, Associate Professor, Faculty of Public Policy, Kyoto Prefectural University, Japan; Dr. Achim Lerch, Professor, FOM University of Applied Sciences for Economics and Management, Germany. Contact: rudolph@econ.kyoto-u.ac.jp. This article results from research projects funded by The University of Newcastle 2017 International Research Visiting Fellowship Scheme (IRVF) and The Japan Society for the Promotion of Sciences Grants-in-Aid for Scientific Research (KAKENHI No. KK20160009).

References

[1] Hahn, RW & Hester, GL. Where Did All the Markets Go? Analysis of EPA's Emissions Trading. *Yale Journal on Regulation* 6 109-153 (1989)
[2] Hahn, RW. Jobs and environmental quality – some implications for instrument choice. *Policy Sciences* 20, 289-306 (1987).
[3] Spash, CL. *The Brave New World of Carbon Trading* (Norwegian University of Life Sciences, Ås 2009).
[4] Dales, JH. Land, Water, and Ownership. *Canadian Journal of Economics* 1, 791-804 (1968).
[5] Montgomery, DW. Markets in Licenses and Efficient Pollution Control Programs. *Journal of Economic Theory* 5, 395-418 (1972).
[6] Endres, A. *Environmental Economics – Theory and Policy* (Cambridge University Press, Cambridge, 2011)
[7] Ranson, M & Stavins, RN. Linkage of greenhouse gas emissions trading systems. *Climate Policy* (2015) (doi: 10.1080/14693062.2014.997658).
[8] Daly, HE. Allocation, distribution, and scale: towards an economics that is efficient, just, and sustainable. *Ecological Economics* 6, 185-193 (1992).
[9] Rudolph, S et al. Towards Sustainable Carbon Markets. In *Carbon Pricing, Growth and the Environment – Critical Issues in Environmental Taxation XI* (Kreiser, L et al., ed), 167-183 (Edward Elgar, Cheltenham, UK/Northampton, US, 2012).
[10] ICAP. *Emissions Trading Worldwide – Status Report 2017* (Berlin, 2017).
[11] Keohane, N, Petsonk, A & Hanafi, A. Toward a club of carbon markets. *Climatic Change* (2015) (doi: 10.1007/s10584-015-1506-z).
[12] Under2 [online] (2017). http://under2mou.org/.
[13] WBGU. Klimapolitik nach Kopenhagen – Auf drei Ebenen zum Erfolg [in German] (Berlin, 2010).
[14] Kemfert, C. Der Emissionshandel ist klinisch tot [in German]. *Unternehmen & Gesellschaft* 2015, 74-77 (2015).
[15] Rudolph, S, Lerch, A & Kawakatsu, T. Developing the North American Carbon Market – Prospects for Sustainable Linking. In *Critical Issues in Environmental Taxation Vol. XVIV* (Weishaar, S et al., eds), Ch. 14 (Edward Elgar, Cheltenham, UK/Northampton, US, 2017).
[16] Tokyo Metropolitan Government Bureau of the Environment. Situation of emissions trading (2017)
[17] Rudolph, S. How the German Patient Followed the Doctor's Orders – Political Economy Lessons from Implementing Market-Based Instruments in Germany. In *Critical Issues in Environmental Taxation – International and Comparative Perspectives Vol. VII* (Lye, LH et al., eds), 587-606 (Oxford University Press. Oxford, 2009).
[18] For reference see endnote 15.
[19] Nishida, Y & Hua, Y. Motivating Stakeholders to Deliver Change. *Building Research & Information* 39, 518-533 (2011).
[20] Rudolph, S & Morotomi, T. Acting Local! An Evaluation of the First Compliance Period of Tokyo's Carbon Market. *Carbon and Climate Law Review* 10, 75-78 (2016)
[21] Mueller, DC. *Public Choice – A Handbook* (Cambridge University Press, Cambridge, 2003).
[22] Herder-Dorneich, P. *Politisches Modell zur Wirtschaftstheorie* (Franz Goerlich, Freiburg, 1959).
[23] Smith, A. An Inquiry into the Nature and Causes of the Wealth of Nations – Volume I (Liberty Fund, Indianapolis, 1776/1981).
[24] Kirchgässner, G & Schneider, F. On the political economy of environmental policy. *Public Choice* 115, 369-396 (2003).
[25] Downs, A. Up and Down with Ecology. *Public Interest* 28, 38-50 (1972).
[26] Michaelowa, A. Übertragung des Demokratiemodells der Neuen Politischen Ökonomie auf die Klimapolitik [in German with English abstract]. *Zeitschrift für Umweltpolitik und Umweltrecht* 21, 463-491 (1998).
[27] Hansjürgens, B. Symbolische Umweltpolitik – Eine Erklärung aus Sicht der Neuen Politischen Ökonomie [in German]. In *Symbolische Umweltpolitik* (Hansjürgens, B & Lübbe-Wolf, G, eds), 144-183 (Suhrkamp, Frankfurt, 2000).
[28] Olson, M. *The Logic of Collective Action – Public Goods and the Theory of Groups* (Harvard University Press, Cambridge, 1965).
[29] Buchanan, JM & Tullock, G. Polluters' Profits and Political Response – Direct Controls Versus Taxes. *American Economic Review* 65, 139-147 (1975).
[30] Holzinger, K. *Umweltpolitische Instrumente aus Sicht der staatlichen Bürokratie – Versuch der Anwendung der Ökonomischen Theorie der Bürokratie* [in German] (Ifo-Institut für Wirtschaftsforschung, München, 1987).

[31] Schneider, F, Kollmann, A & Reichl, J &. *Political Economy and Instruments of Environmental Politics* (MIT Press, Cambridge, 2015).
[32] Schmalensee, R & Stavins, R. Lessons Learned from Three Decades of Experiences with Cap-and-Trade (MIT CEEPR, Cambridge, WP 2015-015, 2015).
[33] Öko Institute. Zusatzerträge von ausgewählten deutschen Unternehmen und Branchen im Rahmen des EU-Emissionshandelssystems – Analyse für den Zeitraum 20052012 [in German] (Berlin).
[34] Markussen, P & Svendsen, GT. Industry lobbying and the political economy of GHG trade in the European Union. *Energy Policy* 33, 245-255 (2005).
[35] Rudolph, S & Schneider, F. Political barriers of implementing carbon markets in Japan – A Public Choice analysis and the empirical evidence before and after the Fukushima nuclear disaster. *Environmental Economics and Policy Studies* 15, 211-235 (2013).
[36] For reference see endnote no. 14.
[37] Barnes, P. Who Owns the Sky?: Our Common Assets And The Future Of Capitalism (Island Press, Washington DC, 2003).
[38] Costanza, R and Daly HE. Natural Capital and Sustainable Development. *Conservation Biology* 6, 37-46 (1992)
[39] Rudolph, S & Kawakatsu, T. Tokyo's Greenhouse Gas Emissions Trading Scheme – A Model for Sustainable Megacity Carbon Markets? In *Market-Based Instruments – Experiences in Environmental Sustainability – Critical Issues in Environmental Taxation, Vol. XIII* (Kreiser. L et al., eds), 77-93 (Edward Elgar, Cheltenham, UK/Northampton, US, 2013).
[40] For reference see endnote no. 17.
[41] Rudolph, S. *Handelbare Emissionslizenzen – Die politische Ökonomie eines umweltökonomischen Instruments in Theorie und Praxis* [in German] (Metropolis, Marburg, 2005).
[42] For reference see endnote no. 15.
[43] For reference see endnote no. 39.
[44] Oates, WE. A reconsideration of environmental federalism. In *Environmental Policy and Fiscal Federalism* (Oates, WE, ed), Ch. 7 (Edward Elgar, Cheltenham UK/Northampton, US, 2004).
[45] Ostrom, E. *A Polycentric Approach for Coping with Climate Change* (World Bank, Washington, DC, Policy Research Working Paper 5095, 2009).
[46] For reference see endnote no. 7.